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ABSTRACT

Intended for use in vocational high schools, the workbook is designed to help the student understand and develop skill in performing the four basic arithmetical operations: addition, subtraction, multiplication, and division. Also stressed is the correct reading and writing of numbers. The booklet consists of explanatory text, arithmetic problems, problems with practical applications (written as job assignments), puzzles, and quizzes. (RG)

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STATE OF NEW JERSEY
DEPARTMENT OF EDUCATION
DIVISION OF VOCATIONAL EDUCATION

Basic Mathematics Operations

-A Math Practice Booklet

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U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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State of New Jersey
Department of Education
Division of Vocational Education

BASIC MATHEMATICS OPERATIONS

- A MATH PRACTICE BOOKLET

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OBJECTIVES

Despite the prevalence of pocket and desk computers, the day has not yet arrived when a person can get along without the skills involved in the four fundamental operations.

After practicing on the material in this book, the student should be able to:

1. Read and write whole numbers correctly.
2. Place numbers in columns and add the columns accurately.
3. Subtract numbers accurately.
4. Multiply numbers accurately.
5. Divide numbers giving no remainder.
6. Divide numbers giving a remainder.

TO THE STUDENT

A skilled tradesman must know how to do the basic operations of mathematics. The carpenter must know how many sheets of exterior plywood to use on a house, or how many lengths of molding are needed for a room. The plumber must know how much pipe to order for a job; the painter, how much paint; the cook, how much of each ingredient will be needed when a recipe is doubled, halved, and so on; the health worker, how to summarize data on a patient; etc., etc., etc. These are a small fraction of the needs of a worker so far as mathematics is concerned.

To do any of these things, a worker must *know how* to perform the operations of mathematics and must gain some *skill* in doing them.

This booklet will help you review the methods and some shortcuts in doing these basic operations.

READING AND WRITING NUMBERS

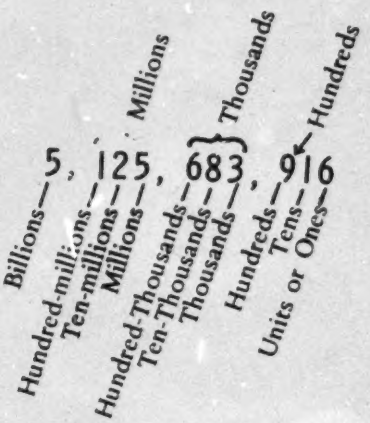
Once you are on your own in this world, you will open a checking account. On checks, you must write a number both in figures and in words. This is one important reason for being able to write out a number in words.

Changing from figures to words or words to figures is also very important when giving or receiving orders by telephone. If you order, say, 108 pieces, you don't want to be surprised by 180 of them!

Since we talk in words, we must be sure that we get across the exact number of things we are talking about.

As you know, it is the *position* of a digit (single figure) within a number that gives it its value. The 9 in the number 129 stands for a count of 9 things. The 9 in the number 912 stands for *900* things. It all depends on its *position* within the number.

Below is a summary of the place-value of digits. Look it over as a review, and then go on to the examples below.



You know how to read any two-digit number. The number 16 is read "sixteen"; the number 57 is read "fifty-seven". They are easy enough. It's the larger numbers that give us trouble, as, for example, (A) 1,253 (B) 47,635 (C) 20,009.

To read a large number correctly:

1 Separate it into 3-place sections by commas, working from right to left.
2. Read each section as it should be read, from left to right – but add on the section name: "million," "thousand," or "hundred."

Example A: Read correctly 1253.

1,253	Starting from the right and moving to the left, separate the digits, by commas into groups of three.
1 is read "thousand."	The 1 is in the thousands section.
253 is read "two hundred fifty-three."	The 2 is in the hundreds place, and 53 is read "fifty-three."
Therefore, 1,253 is read "one thousand, two hundred fifty-three."	Putting both sections of the number together.

Example B: Read correctly 47635.

47,635	Starting from the right and working left, separate the digits into groups of three.
47 is read "forty-seven thousand."	Reading from left to right, the 47 is in the thousands section.
635 is read "six hundred thirty-five."	The 6 is in the hundreds place, and 35 is read "thirty-five."
Therefore 47,635 is read "Forty-seven thousand, six hundred thirty-five."	Putting both sections of the number together.

Example C: read correctly 20009

20,009	Separate into groups of three.
20 is read "twenty thousand"	The 20 is in the thousands section.
009 is read "nine."	The two zero's set the proper position for the 9 but do not themselves add to the value of the number.
Therefore 20,009 is read "Twenty thousand and nine"	Putting both sections of the number together. (The "and" makes the number easier to understand.)

Note: The numbers between twenty-one and ninety-nine get hyphens when written out. Check the first two examples above.

Job Assignment 1:

Read and write in words the following numbers:

(1) 1,256

(2) 38,690

(3) 864

(4) 9,059

(5) 56,308

(6) 49,716

(7) 13,995

(8) 21,004

(9) 365,295

(10) 2,100,102

(11) 59,005

(12) 3,606

(13) 108,597

(14) 11,206

(15) 4,200,300

ADDITION

To Add Numbers

1. Write the problem down vertically (straight up and down in a column).
2. Add the right-hand column (units column) first.
3. When adding, group your numbers wherever possible and add the group totals. (groups of 10 are particularly easy to use.)
4. If the sum of the digits is larger than 9, write down the units number and carry over the other number into the tens column.
5. Continue to follow this method, working from right to left.

Example A: Add 37 and 6

Step I
```
  37
+  6
```
Write the problem vertically (in a column)

Step II
```
  37   Carry over
+1 6   into tens col.
   3 Units
```
Add the numbers in the units column: 7 + 6 = 13. Write the 3 in the units column and carry over the 1 in the tens column.

Step III
```
  37
+1 6
  43 Answer
```
Now add the numbers in the tens column: 3 + 1 (carry-over) = 4.

Example B: Add 2, 8, 7, 3, 6, 9.

Step I

2
8
7
3
6
9

Write the problem vertically.

Step II

(2, 8) 10; (7, 3) 10; 20; (6, 9) 15

Try to group the numbers. Here I can group 2 and 8 (= 10); 7 and 3 (= 10); 6 and 9 (= 15). Write down the sums of the groups. (When you get skillful at this, you can add the groups in your mind.)

Step III
```
  20
  15
 ---
  35 Answer
```
Add tens ↗ ↖ Add units

Add the groups together. 5 + 0 = 5.
Write the 5 in the units column (no carryover). 2 + 1 = 3.

Example C: Add 14, 13, 9, 8, 17.

Step I
```
14
13
 9
 8
17
```
Write the problem vertically.

Step II
```
14 )
13 ) 7
 9 )
 8 ) 17 ) 14
 7 )
---
51 Answer
```
Try to group some numbers in the units column. Here I grouped 4+3+7=14; 9+8=17. Add the two groups: 17+14=31. Write the 1 in the units column and carry over the 3 into the tens column. Now 3+1+1=5.

Groups added
```
 17
 14
---
 31
```

Job Assignment 2:

Add the following columns of numbers:

(1)	35	(2)	98	(3)	48	(4)	56
	43		46		99		24
	68		31		22		35
	92		12		10		
(5)	63	(6)	25	(7)	14	(8)	13
	22		20		36		64
	41		9		52		91
(9)	39	(10)	78	(11)	3	(12)	36
	48		52		41		63
	22		67		50		24

(13) 38
37
42

(14) 69
58
43

(15) 67
99
40

(16) 583
492
671

(17) 693
708
481

(18) 105
267
485

(19) 597
205
1783

(20) 480
999
156

(21) 982
673
403

(22) 201
592
749

(23) 843
261
5836

(24) 685
291
486
590

(25) 6789
3892
4803
2296

Job Assignment 3:

Add the following columns of numbers:

(1) 4863
2291
4800
209
672
586

(2) 1005
296
581
2986
3554
1280
49

(3) 56933
2948
48729
4863
291
5863

(4) 489
50
92
561
295
348
782

(5) 9872
488
672
1003
209
1570

(6) 7896
483
9299
5480
6320
9807

(7) 41872
9286
4263
3598
7891
60052

(8) 60935
7098
58621
4863
99921
68325

(9) 5063 + 352 + 109 + 63 + 7986 + 859 =

(10) 3592 + 5863 + 7798 + 6593 + 329 + 6053 =

Job Assignment 4:

You are a clerk in a department store. School has just opened and many people are buying clothes. Your supervisor comes to you and asks you to figure out your total sales for each day and also the total sales for each type of item sold this week. The amounts are below. (As a check on your addition, the Total column on the right should add up to the same number as the sum of all the individual totals across the bottom of the chart.)

Departmental Sales Report

Week Ending Sept. 15, 19 ____

	Departments				
Day	Dresses	Coats	Lingerie	Accessories	Totals
Monday	$468	$353	$147	$ 99	
Tuesday	394	429	200	205	
Wednesday	527	368	677	144	
Thursday	446	392	198	216	
Friday	382	416	147	147	
Saturday	943	871	543	377	
TOTALS					

Job Assignment 5:

Back in 1975 you were a car salesman for Chevrolet. Listed below are seven popular cars and options that 10 people bought. Find out the total cost for each car. Use $170 for the destination charge for each car. Disregard sales tax. (Hint: Cost = Base Price + Option Costs + Destination Charge)

Manufacturer's Suggested Retail Price

Car Model	Base Price	Optional Engine	Air Conditioning	Power Steering	Power Brakes	Auto. Trans.	Radial Tires	Radio AM	Radio AM/FM Stereo
Vega Hatchback 4-cyl. engine	$2900	2-bbl. 140 cu.in. $50	$398	$111	N.A.	$235	$119	$63	$213
Monza 2+2 Hatchback 4-cyl. engine	$3953	V-8 4.3 litre $198	$398	$111	$51*	$235	$119	$63	$213
Nova Hatchback 6-cyl. engine	$3347	V-8 4.3 litre $166	$435	$129	$55	$235	Stand.	$69	$233
Camaro 6 cyl. engine	$3540	V-8 350 cu.in. $145	$435	Stand.	$55	$235	Stand.	$69	$233
Chevelle 2-door 6-cyl. engine	$3407	V-8 350 cu.in. $251	$579**	Incl. with A/C	$55	$235	Stand.	$69	$233
Monte Carlo 2-door Std. V-8	$4249	4-bbl. 350 cu.in. $54	$450	Stand.	Stand.	$235	Stand.	$69	$233
Caprice Classic 4-dr. Std. V-8	$4819	4-bbl. 350 cu.in. $54	$458	Stand.	Stand.	Stand.	Stand.	$69	$233

* Included as standard with V-8 engine

** Includes power steering. Price is $505 with 8-cylinder engine and includes power brakes only

NA = Not available

Car Buyer 1: Car - Nova. Options: A/C, power steering, power brakes, A.M. radio.

Car Buyer 2: Car – Vega. Options: Automatic transmission, power steering, radial tires, AM/FM stereo radio.

Car Buyer 3: Car – Monza. Options: V–8 engine, A/C, power steering, power brakes, automatic transmission, radial tires, AM radio.

Car Buyer 4: Car – Caprice. Options: 4-barrel, 350 cu. in. engine, A/C, AM/FM stereo radio.

Car Buyer 5: Car – Camaro. Options: Power brakes automatic transmission, AM radio.

Car Buyer 6: Car – Chevelle. Options: A/C, power steering, power brakes AM radio.

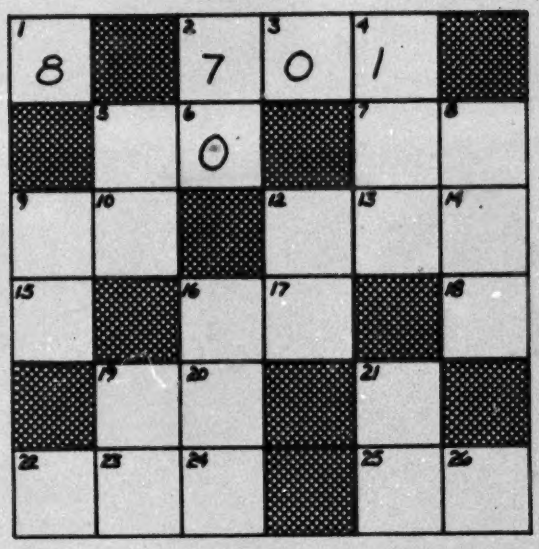
Car Buyer 7: Car – Chevelle. Options: V-8 engine, A/C, power brakes, automatic transmission AM/FM stereo radio.

Car Buyer 8: Car – Vega. Options: Optional engine, automatic transmission, radial tires, AM radio.

Car Buyer 9: Car – Caprice. Options: 4-barrel, 350 cu. in. engine. A/C, AM radio.

Car Buyer 10 Car – Monza. Options: A/C. power steering, power brakes, radial tires, AM/FM radio.

PUZZLE



ACROSS

(1) 5 + 3

(2) 671 + 30

(5) 25 + 5

(7) 3 + 19 + 25 + 6

(9) 12 + 16 + 7 + 60

(12) 542 + 85 + 223

(16) 4 + 8 + 6 + 5 + 9 + 14

(19) 17 + 18 + 43 + 7 + 10

(22) 23 + 41 + 75 + 120

(25) 13 + 16 + 7 + 20

DOWN

(2) 61 + 4 + 5

(4) 25 + 60 + 28 + 42

(5) 28 + 7

(8) 105 + 50 + 60 + 90

(9) 56 + 14 + 10 + 6 + 13

(12) 23 + 30 + 14 + 19

(16) 35 + 109 + 263 + 52

(19) 26 + 42 + 18 + 7 + 2

(21) 7 + 8 + 6 + 3 + 4 + 9 + 6 + 2

SUBTRACTION

When subtracting numbers in day-to-day problems, you can only subtract a smaller number from a larger number. Example: Your restaurant starts off the week with 48 #10 cans of vegetables, and has 13 cans left at the end of the week. How many were used?

Solution:

48 cans to start
- 13 cans left
35 cans used

Subtraction is the opposite operation to addition. That is, whenever you subtract one number from another, you are really saying, "What number when added to this number equals the above total?" In the above problem, this is how it would be solved.

Step I	48 - 13	Write the problem
Step II	48 - 13 35	Begin at the right, as with addition. What number added to 3 equals 8? Your answer is 5. What number added to 1 equals 4? Answer, 3. What number added to 13, then, equals 48? Answer, 35.

Job Assignment 6

Subtract the following:

(1) 9 - 2	(2) 8 - 5	(3) 13 - 2	(4) 15 - 3	(5) 33 - 1
(6) 24 - 11	(7) 7 - 4	(8) 5 - 1	(9) 8 - 5	(10) 13 - 3
(11) 36 - 3	(12) 12 - 6	(13) 23 - 1	(14) 10 - 7	(15) 12 - 4

Job Assignment 7:

Subtract the following problems:

(1)	25 - 11	(2)	36 - 12	(3)	42 - 21	(4)	69 - 12	(5)	84 - 11
(6)	49 - 36	(7)	23 - 13	(8)	69 - 24	(9)	88 - 26	(10)	72 - 12

"Borrowing" in Subtraction

Sometimes when subtracting, "borrowing" from the next higher place becomes necessary. The following examples will review the method for you.

Example: Subtract 15 from 53.

Step I
```
  53
- 15
```
Write the problem. Starting on the right, note that 5 cannot be subtracted from 3, because 5 is larger than 3.

Step II
```
 4  1
 5  3
-  5
```
Now borrow 1 from the 5, leaving 4. (You are really borrowing 10.) By placing the 1 in front of the 3, you are adding the 10 to the 3. This 3 is now 13.

Step III
```
 4  1
 5  3
-  5
-----
 3  8  Answer
```
Now subtract: 5 from 13 = 8 and 1 from 4 is 3.

Job Assignment 8:

Subtract the following:

(1)	78 30	(2)	63 34	(3)	21 16	(4)	289 192	(5)	72 25
(6)	18 11	(7)	382 296	(8)	91 67	(9)	221 109	(10)	61 59

(11)	6873 2780	(12)	101 99	(13)	78 39	(14)	473 386	(15)	726 419
(16)	783 693	(17)	207 196	(18)	489 296	(19)	10035 9829	(20)	5672 3785

Job Assignment 9:

You are a bank depositor with National Community Bank. Your account number is 658367 and you have made the following deposits and withdrawals in your account. How much money is in your account at the end of March?

Total in your account on February 28, $758

3/1/7__	Deposited $259
3/5/7__	Withdrawal – $50
3/8/7__	Deposited – $100
3/17/7__	Withdrawal – $49
3/20/7__	Withdrawal – $75
3/23/7__	Deposited – $346
3/30/7__	Withdrawal – $400
	Total at end of month _____

Your bank statement credits you with $1162.

If your total does not agree with the bank's total, what is the difference in amounts?

Quiz on Addition and Subtraction

(1) $14 + 13 + 9 + 8 + 17$ (1) _____

(2) $45 + 9 + 10 + 3 + 6$ (2) _____

(3) $982 + 673 + 403$ (3) _____

(4) $7896 + 483 + 9299 + 5480 + 6320$ (4) _____

(5) $5063 + 8026 + 352 + 109 + 63$ (5) _____

(6) $42426 + 54545 + 11545 + 21352$ (6) _____

(7) $65 + 191 + 506 + 5153$ (7) _____

(8) $178 + 177 + 39 + 196 + 118 + 205 + 79$ (8) _____

(9) $5620 + 85 + 4130 + 293 + 6454 + 2573$ (9) _____

(10) $3645 + 7152 + 3313 + 426 + 74 + 5231$ (10) _____

(11) _____

(12) _____

(13) _____

(14) _____

(15) _____

(16) _____

(17) _____

(18) _____

(19) _____

(20) _____

Subtract the following:

(11) 25 − 18	(12) 81 − 53	(13) 391 − 126	(14) 882 − 274	(15) 276 − 149
(16) 10035 − 9829	(17) 6873 − 2980	(18) 783 − 693	(19) 289 − 192	(20) 5672 − 3785

MULTIPLICATION

Multiplication is really repeated addition. This operation saves a good deal of time – we do not have to add up many similar numbers. The clerk in a store taking inventory (seeing how many items are in stock) does not want to keep adding the same number. This takes too long. So he uses multiplication to speed up the process: 5 cases, with 24 in a case, gives him a total of 5 x 24 or 120. He does have to add 24 + 24 + 24 + 24 + 24.

In order to multiply, you *must* know your multiplication table. For review, the table is given here. Learn it.

	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18
3	0	3	6	9	12	15	18	21	24	27
4	0	4	8	12	16	20	24	28	32	36
5	0	5	10	15	20	25	30	35	40	45
6	0	6	12	18	24	30	36	42	48	54
7	0	7	14	21	28	35	42	49	56	63
8	0	8	16	24	32	40	48	56	64	72
9	0	9	18	27	36	45	54	63	72	81

If you forget a certain product, here's how to find it from the table:

Example A: 5 x 9 =

Step I	5 Multiplier x 9 Multiplier	Write the problem.
Step II	45 Product	Look down the column marked 5 until you come to the row marked 9. Where the column meets the row is your answer – 45.

In the above example, what would you find if you used the *column* marked 9 and the *row* marked 5?

Example B: 32 X 7

Step I	32 x 7	Write the problem
Step II	$^{1}32$ Place 1 here x 7 4 Place 4 here	Multiply the right-hand digit (2) of the upper multiplier by the lower multiplier (7): 7X2=14. Place the 4 down in the product and write the 1 in front of the 3 in the upper multiplier.
Step III	$^{1}32$ x 7 224 Product	Now multiply the 3 by the 7; then add what you carried: 7 x 3 = 21, +1 that was carried, = 22. Put this in front of the 4.

Job Assignment 10:

Multiply the following: (It is easier to work multiplication problems if you use the larger number as the upper multiplier.)

(1)	7 x 9	(11)	2 x 202
(2)	6 x 3	(12)	6 x 149
(3)	4 x 5	(13)	1 x 563
(4)	8 x 3	(14)	8 x 36
(5)	4 x 2	(15)	24 x 14
(6)	7 x 7	(16)	6 x 23
(7)	12 x 6	(17)	18 x 9
(8)	32 x 9	(18)	23 x 9
(9)	5 x 23	(19)	65 x 7
(10)	4 x 61	(20)	48 x 6

To multiply numbers containing two or more digits:

1. Multiply the entire upper multiplier by the right-hand digit in the lower multiplier, as we did in the previous example.

2. Start writing the product directly under the number you are multiplying by.

3. Then multiply the entire upper multiplier by the next-to-right-hand digit in the lower multiplier.

4. Start writing this product directly under the number you are multiplying by.

5. Repeat this for any other digits in the lower multiplier.

6. Add the partial products to find the full product.

Example Multiply 17 x 23.

Step I	23 x 17	Upper multiplier Lower multiplier	Write the problem.
Step II	$^{2}23$ x 17 161	Partial product	Multiply the entire upper multiplier by the right-hand digit in the lower multiplier. (7): 7 x 3 = 21. Write down the 1 and carry the 2; 7x2 = 14, + 2 = 16. Partial product is therefore 161.
Step III	23 x 17 161 23	← The 3 goes right under the multiplier (1).	Multiply the entire upper multiplier by the next digit in the lower multiplier (1). Start answer right below the digit. 1 x 3 = 3; 1 x 2 = 2. Partial product is therefore 23.
Step IV	391	Product	Now add the columns.

Job Assignment 11:

Multiply the following:

(1) 25 x 16 (2) 49 x 23 (3) 14 x 12 (4) 34 x 11 (5) 63 x 29

(6) 42 x 75 (7) 87 x 19 (8) 72 x 12 (9) 19 x 105 (10) 99 x 20

(11) 85 x 62 (12) 26 x 21 (13) 35 x 16 (14) 79 x 94 (15) 105 x 60

(16) 225 x 31 (17) 62 x 580 (18) 456 x 206 (19) 502 x 375 (20) 857 x 195

Job Assignment 12:

You work for Shop Rite, and it is time to inventory your stock. Your job is to find out the number of cans of each product in one section of the storeroom. You count the cartons and write down all the information you gather, in the table shown below. Now complete the table for each item and get the total of all the items.

Item	Number of cartons	No. Cans Per carton	Total No. of Cans
Niblet Corn 16 oz. Green Giant	8	24	
Cut wax beans 16 oz. Green Giant	14	24	
Cream Corn 8 oz. Green Giant	6	48	
Cream Corn 16 oz. Green Giant	32	24	
Green Peas 8 oz. Green Giant	18	48	
Green Peas 16 oz. Green Giant	12	24	
Whole Potatoes 8 oz. Green Giant	10	48	
Whole Potatoes 16 oz. Green Giant	8	24	
Sliced Potatoes 16 oz. Green Giant	11	24	
Tomato Sauce 8 oz. Del Monte	13	72	
Tomato Sauce w/onion 8 oz. Del Monte	19	72	
Tomato Puree 16 oz. Del Monte	16	24	
Tomato Puree 28 oz. Progresso	24	12	
Total Items in Section			

Job Assignment 13:

A. In mechanics, work done by a person, tool, or machine is measured in foot-pounds. To find the number of foot-pounds, you multiply the *distance* an object is moved by the amount of *force* it take to move it. The idea is expressed by this *formula.* W = F x D
or Work (in ft.-lbs.) = F (in lbs.) x D (in feet)

Find the work done in moving the following:

(1) Force = 15 lbs. Distance = 9 ft. W =

(2) Force = 125 lbs. Distance = 3 ft. W =

(3) Force = 50 lbs. Distance = 230 ft. W =

(4) Force = 63 lbs. Distance = 70 ft. W =

(5) Force - 21 lbs. Distance = 6 ft. W =

B. In electricity, electrical power is measured in watts. To find the number of watts used by an electrical device, you multiply the applied *electromotive force* (measured in *volts*) by the *intensity* or *rate of flow* of the electric current (measured in *amperes*). Written as a formula: W = E x I

Find the number of watts used in each case:

(1) Volts (E) = 110 Amps (I) = 12 W =

(2) Volts (E) = 115 Amps (I) = 5 W =

(3) Volts (E) = 220 Amps (I) = 130 W =

(4) Volts (E) = 110 Amps (I) = 30 W =

(5) Volts (E) = 115 Amps (I) - 15 W =

HERE IS A CHANGE OF PACE

Teaser – for men only. What's Your Wife's Name?

If you're not married, and you answer these questions honestly, you'll be told the name of your future wife. If you're married, you'll be told the name of your present wife.

1. Write down the number corresponding to the month of your birth (Table 1).
2. Add the number corresponding to your favorite dish (Table 2).
3. Multiply the answer by 10. Then add 3 if you want to know the name of your future wife, 2 for your present wife, and 1 for your former wife.
4. Reverse the order of figures, and subtract the result from the number you had before reversing. Thus, if the number is 521, it becomes 125. Subtracting, 521 - 125 = 396.
5. Reverse this answer and add the result to the number it was before reversing.
6. Now add 52,205, 197 if you are a mayor or governor; otherwise, add 423,571.
7. Look up the number corresponding to the first letter of your last name from Table 3, and place to the right of the previous answer. If for example, your name is Smith and your previous answer was 123,456, you would place the two figures corresponding to 5, which are 60, on the right, giving you 12,345,660.
8. Add the numbers for the next letter of your last name, then for the next, and so on, for your entire name.
9. Take half of this number (divide it by 2).
10. Divide the answer into groups of 2 figures. Each group represents a letter of your wife's name. Use Table 4 this time. For example, if the answer is 21-10-23-43, her name will be Mary.

Table 1

January	90	July	70
February	80	August	80
March	70	September	90
April	60	October	80
May	50	November	70
June	60	December	60

Table 2

Roast Beef and Potatoes	9
Steak and Onions	8
Hamburger and French Fries	7
Ham and Eggs	6
Chicken and Rice	5
Franks and Beans	4
Tuna Fish Casserole	3

Table 3

A – 20	G – 64	M – 42	T – 44
B – 40	H – 68	N – 66	U – 28
C – 48	I – 24	O – 26	V – 84
D – 62	J – 80	P – 82	W – 88
E – 22	K – 54	Q – 90	X – 58
F – 50	L – 52	R – 46	Y – 86
		S – 60	Z – 56

Table 4

10 – A	21 – M	27 – K	34 – H
11 – E	22 – T	28 – Z	40 – J
12 – I	23 – R	29 – X	41 – P
13 – O	24 – C	30 – S	42 – V
14 – U	25 – F	31 – D	43 – Y
20 – B	26 – L	32 – G	44 – W
		33 – N	45 – Q

DIVISION

In the last section we explained multiplication as repeated addition. Similarly, division can be thought of as repeated subtraction, or as the opposite of multiplication.

When dividing numbers, you are trying to find out how many times one number is contained in another.

You might ask, "How many 6's are there in 24?" If we wanted to, we could keep subtracting 6 from 24 and see how many times we have to do this.

```
  24
- 6   once
  18
- 6   twice
  12                Therefore there are four 6's in 24.
- 6   three times
   6
- 6   four times
   0
```

Or you could look at division as the opposite of multiplication and say, "What number multiplied by 6 will give 24?" The answer is 4, because 4 multiplied by 6 equals 24.

Of course the second way will give us the answer a lot faster than the first way.

The following are the names to the parts of a division problem:

36 divided by 7

```
          5  ←quotient
divisor→ 7 ) 36  ←dividend
           35
           1  ←remainder
```

The 7 is called the *divisor*. (The number outside division box. It is *doing* the dividing.)

36 is called the *dividend*. (The number inside division box. It is *being divided into.*)

5 is called the *quotient*. (The answer, giving the number of times 7 is contained is 36.)

If the divisor does not divide evenly into the dividend, the amount left is called the *remainder.* Here 1 is the remainder.

To do any division problems, you must know the multiplication table (page 16).

Example A: 28 divided by 7

Step I	$7\overline{)28}$	Write the problem, using the division symbol.
Step II	$7\overline{)28}$	Since 2, the first digit in the dividend, is smaller than 7, we look at the number 28 in the dividend rather than the number 2. You say to yourself, "What number times 7 gives 28 or almost 28?" Recall that 7x4 = 28. Place the 4 in the quotient.
Step III	$\begin{array}{r} 4 \\ 7\overline{)28} \\ 28 \\ \hline 0 \end{array}$	7x4 = 28 --multiplying the divisor by the quotient. Place this product below the dividend and subtract them.
Step IV	28 divided by 7 = 4	The quotient is the answer to the problem.

Example B: 90 divided by 6

Step I	$6\overline{)90}$	Write the problem using the division symbol.
Step II	$\begin{array}{r} 1 \\ 6\overline{)90} \end{array}$	This time the first digit in the dividend, 9, is larger than the divisor. 6 times what number equals 9 or almost 9? 6x1 = 6, which is smaller than 9. Write the 1 as a partial quotient.
Step III	$\begin{array}{r} 1 \\ 6\overline{)90} \\ 6\downarrow \\ \hline 30 \end{array}$	6x1 = 6; write the product 6 under the 9. Subtract 6 from 9, which leaves 3. This is smaller than 6 as it should be. Now bring down the next number in the dividend, 0.
Step IV	$\begin{array}{r} 15 \\ 6\overline{)90} \\ 6 \\ \hline 30 \\ 30 \\ \hline 0 \end{array}$	Divide again: 6 times what number equals 30 or almost 30? 6x5 = 30, so write the 5 in the quotient. Multiply the divisor (6) by the 5, giving 30. Place this result under the 30 already there and subtract. 30 ÷ 30 = 0, and so there is no remainder.

Step V 90 divided by 6 = 15. The whole quotient is the answer to the problem.

Example C: 338 divided by 14

Step I $14\overline{)338}$ Write the problem using the division symbol.

Step II
$$\begin{array}{r} 2 \\ 14\overline{)338} \\ 28^{x} \\ \hline 58 \end{array}$$

Since 14 will not go into 3, we must divide it into 33.
14 times what number equals 33 or almost 33?
14x2 = 28, so put 2 in the quotient.
Write the product 28 under the 33 and subtract: 33 - 28 = 5.
Then bring down the next number, 8. 14 times what number equals 58 or almost 58?

Step III
$$\begin{array}{r} 24 \\ 14\overline{)338} \\ 28 \\ \hline 58 \\ 56 \\ \hline 2 \end{array}$$

14x4 = 56, so put the 4 in the quotient.
Multiply the divisor by 4; place that result, 56 under the 58.
Subtract. There is a remainder of 2, and no more numbers to bring down.

Step IV
$$\begin{array}{r} 14\ \text{R}\ 2 \\ 14\overline{)338} \\ 28 \\ \hline 58 \\ 56 \\ \hline 2 \end{array}$$

Indicate the remainder with an R as part of the quotient.

Summary on division:

1. See how many times the divisor is contained in the first number or numbers of the dividend, without going over that amount.
2. Place that result in the quotient.
3. Multiply the divisor by the quotient and place this product below the dividend number(s) used.
4. Subtract. The new number *must be less than the divisor.* If not, go back and increase your quotient.
5. Bring down the next number in the dividend.
6. Divide again. Repeat steps 1 through 5.

7. Continue this process until you have used all the digits in the dividend.

8. If there is a remainder, place it as part of the quotient.

One more point about division: when dealing with difficult numbers, you can find the right quotient number more easily if you use a good *approximation* for the divisor. For example, if you were asked to divide

$$29\overline{)5250}$$

on first glance you might want to try a 2 as the first number in your quotient. If you realize, however, that 29 is almost 30, you would see that 52 is smaller than 2 x 30. You would look more carefully and check out the 2 before putting it into the quotient. Since 2 x 29 = 58, you know you'll have to use a 1 instead.

In the same way, think of a number like 42 as *more than* 40, a number like 47 as close to 50, and a number like 45 as in between 40 and 50. That way, you'll have less erasing to do!

Job Assignment 14:

Divide the following:

(1)	$7\overline{)49}$	(1) _____
(2)	$9\overline{)108}$	(2) _____
(3)	$5\overline{)55}$	(3) _____
(4)	$2\overline{)36}$	(4) _____
(5)	$3\overline{)48}$	(5) _____
(6)	$12\overline{)156}$	(6) _____
(7)	$13\overline{)260}$	(7) _____
(8)	$23\overline{)322}$	(8) _____
(9)	$34\overline{)850}$	(9) _____
(10)	$10\overline{)150}$	(10) _____
(11)	$45\overline{)495}$	(11) _____
(12)	$9\overline{)3105}$	(12) _____

(13) $67\overline{)2144}$ (13) _____

(14) $16\overline{)272}$ (14) _____

(15) $22\overline{)1870}$ (15) _____

Job Assignment 15:

Divide the following:

(16) $16\overline{)195}$ (16) _____

(17) $23\overline{)648}$ (17) _____

(18) $11\overline{)158}$ (18) _____

(19) $17\overline{)405}$ (19) _____

(20) $25\overline{)631}$ (20) _____

(21) $41\overline{)893}$ (21) _____

(22) $54\overline{)685}$ (22) _____

(23) $33\overline{)962}$ (23) _____

(24) $15\overline{)489}$ (24) _____

(25) $19\overline{)368}$ (25) _____

(26) $42\overline{)805}$ (26) _____

(27) $27\overline{)639}$ (27) _____

(28) $39\overline{)987}$ (28) _____

(29) $40\overline{)248}$ (29) _____

(30) $62\overline{)227}$ (30) _____

Job Assignment 16:

(A) In electricity, the resistance in a circuit is the force that tends to reduce the flow of current. Resistance is measured in ohms. Any electrician knows how to use Ohm's law. From Ohm's law he can find the number of amps (I) in a circuit by dividing the applied voltage (E) by the resistance (R).

$$I = \frac{E}{R} \quad \begin{matrix}\text{(in volts)} \\ \text{(in ohms)}\end{matrix}$$

Find the amps (I), given the following:

(1)	Volts (E)	= 110	Resistance (R)	= 5 ohms	I =
(2)	Volts (E)	= 115	Resistance (R)	= 10 ohms	I =
(3)	Volts (E)	= 110	Resistance (R)	= 40 ohms	I =
(4)	Volts (E)	= 220	Resistance (R)	= 3 ohms	I =
(5)	Volts (E)	= 110	Resistance (R)	= 16 ohms	I =

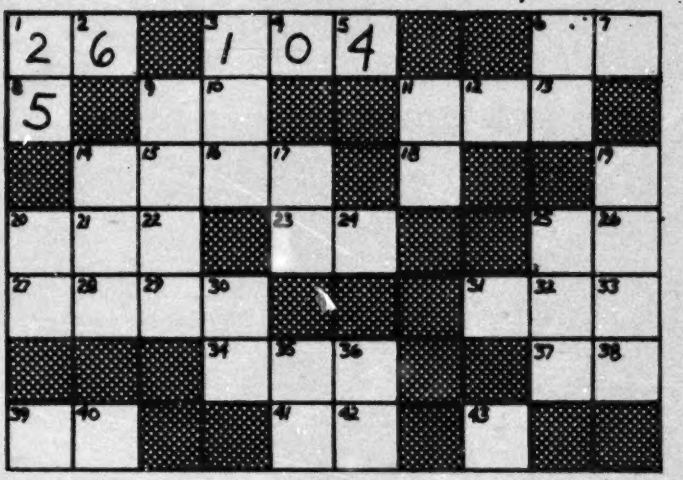
(B) To find how many miles per gallon a car gets, the owner will start with a full tank and note the mileage on the car's odometer. Then the next time he needs gas, he notes how many gallons it takes to fill the tank and he finds out how many miles he has gone by subtracting the previous odometer reading from the new reading. He then divides:

$$\text{Miles per gallon} = \frac{\text{No. of miles traveled}}{\text{No. of gallons used}}$$

Find the number of miles per gallon in the following cases:

	Odometer Readings	No. of Gals. Used	Miles per Gal.
(1)	31652 - 31400	14	
(2)	22515 - 22326	9	
(3)	1496 - 1047	16	
(4)	49854 - 49629	18	
(5)	19121 - 18919	7	

Puzzle



Across

1. 58 - 32
3. 125 - 21
6. 78 - 49
8. 14 - 9
9. 349 - 330
11. 487 - 338
14. 4097 - 2672
18. 37 - 29
20. 47 + 19 + 53
23. 15 x 6
25. 48 + 17 + 26
27. 1768 + 487 + 104
31. 25 x 30
34. 13 x 13
37. 89 - 56
39. 138 - 69
41. 18 x 4
43. 17 - 17

Down

1. 52 - 27
3. 6 x 32
6. 3 x 9 + 2
9. 4873 - 3378
11. 6 x 3 or 2 x 9
14. 113 x 1
17. 109 - 50
19. 1494 + 1609
20. 72 ÷ 6
25. 1625 + 546 - 1218
30. 455 ÷ 5
35. 938 ÷ 14
36. 23 x 4

Review Exercise

I **Add the following:**

(1) 76 + 36 + 47 + 63 + 59 + 23 (1) _____

(2) 91 + 42 + 45 + 92 + 34 + 36 (2) _____

(3) 11 + 94 + 89 + 33 + 5 + 13 + 58 + 10 (3) _____

(4) 50 + 439 + 847 + 79 + 528 + 33 (4) _____

(5) 866 + 575 + 42 + 87 + 745 + 420 + 91 (5) _____

II **Subtract:**

(6)	(7)	(8)	(9)	(10)
9098	7563	9000	9202	8665
- 4359	- 6268	- 159	- 404	- 2936

III **Multiply:**

(11)	(12)	(13)	(14)	(15)
37	45	220	276	256
53	89	76	42	407

IV **Divide:**

(16) $4\overline{)1780}$ (17) $3\overline{)7941}$ (18) $43\overline{)8228}$

(19) $52\overline{)26188}$ (20) $81\overline{)5272}$

Multiply the following:

(1)	25 x 16	(1) _____
(2)	857 x 25	(2) _____
(3)	79 x 34	(3) _____
(4)	64 x 108	(4) _____
(5)	182 x 260	(5) _____
(6)	85 x 600	(6) _____
(7)	225 x 312	(7) _____
(8)	87 x 19	(8) _____
(9)	14 x 1200	(9) _____
(10)	502 x 375	(10) _____

Divide the following:

(11) $12\overline{)156}$

(12) $22\overline{)2706}$

(13) $62\overline{)827}$

(14) $8\overline{)1467}$

(15) $2\overline{)849}$

(16) $74\overline{)2275}$

(17) $95\overline{)16{,}830}$

(18) $49\overline{)345{,}793}$

(19) $81\overline{)5272}$

(20) $33\overline{)962}$